https://doi.org/10.29309/TPMJ/2024.31.04.7936

The Professional Medical Journal
www.theprofesional.com
2024, Volume, 31 Issue, 04

ORIGINAL ARTICLE

Colour blindness prevalence and its awareness in primary school children of Karachi.

Sassi Kanwal[1], Ahtishsm Saleem[2], Khulood Shahid[3], Faiza Nasir[4], Areeb Amir[5], Syeda Bariah Hussain[6]

Article Citation: Kanwal S, Saleem A, Shahid K, Nasir F, Amir A, Hussain SB. Colour blindness prevalence and its awareness in primary school children of Karachi. Professional Med J 2024; 31(04):569-573. https://doi.org/10.29309/TPMJ/2024.31.04.7936

ABSTRACT… Objective: To Assess and compare different types of color blindness in primary school children also to appraise the self-awareness levels regarding this ailment amongst them. **Study Design:** Cross Sectional study. **Setting:** Different Primary Schools of Karachi in Collaboration with Department of Physiology, Jinnah Medical and Dental College Karachi. **Period:** 1st October 2020 to 1st December 2020. **Methods:** 146 primary school children of both genders aged between 5 to 12 years were assessed by prescribed questionnaire and Ishahara Chart for color blindness. **Result:** Out of the 148 students who underwent screening, only 16 were diagnosed with color blindness, indicating a prevalence of 10.8% among primary school children in Karachi. Of these 16 students, males exhibited a higher incidence of color blindness (56.25%) than females (47.35%). **Conclusion:** The incidence of color blindness is higher in males than females with significant association with family history and night blindness. Colour blindness unawareness also significantly found in this study. It is recommended to have an eye checkup at the start of school and to have regular eye examination to avoid any hindrances and get the right help.

Key words: Color Vision Deficiency, Color Blindness, Ishahara Chart.

INTRODUCTION

A class of degenerative retinal illnesses with clinical and genetic diversity is known as retinal dystrophies (RD). In progressive diseases, common manifestations include colour blindness or night blindness, anomalies in peripheral vision, and eventual progression to total blindness.[1] According to the WHO's 2009 report, 6 million children under the age of five are estimated to be night blind in Pakistan. In Pakistan's NWFP, children between the ages of 6 and 12 are evaluated for their risk of developing night blindness and colour blindness. In Karachi, most primary school pupils and youngsters—nearly 20%—are affected by these ailments.[2] The medical condition of being unable to distinguish between colors clearly in environments with adequate lighting is commonly referred to as color blindness. According to the trichromatic theory of color vision, the three classes of cones in the human eye are only partially stimulated by light of different wavelengths.[3]

Color blindness is classified into three types: i) protanopia, where the red cone is missing, affecting 1.01% of men and 0.02% of women, ii) deuteranopia, where the green cones are missing, affecting 1.27% of men and 0.01% of women, iii) tritanopia, where the blue cones are missing, and it is the most uncommon form of dichromacy, affecting only 0.0001% of males. As color blindness is primarily a hereditary illness, its incidence varies by race and geographical region.[4] It is passed on via the X chromosome and is therefore more common in men who only have a single X chromosome, than in women, who have two X chromosomes.[5] Early detection of color vision deficiencies in children can help improve their quality of life and enable them to reach their maximum potential. It is crucial to recognize color vision defects when it comes to choosing a career, and tests must be conducted

1. MBBS, M.Phil (Physiology), Senior Assistant Professor Physiology, Bahria University of Health Sciences, Karachi.
2. MBBS, RMO, RIMS, Karachi.
3. MBBS, RMO, Medicare Hospital, Karachi.
4. MBBS, Lecturer Physiology, Jinnah Medical and Dental College, Karachi.
5. MBBS, RMO, Medicare Hospital, Karachi.
6. MBBS, RMO, Medicare Hospital, Karachi.

Correspondence Address:
Dr. Sassi Kanwal
Department of Physiology
Bahria University of Health Sciences, Karachi.
knowledgefonly@gmail.com

Article received on: 17/10/2023
Accepted for publication: 23/12/2023

during secondary schooling. However, to avoid disadvantaging affected children, there is sufficient evidence to support testing at school entry.[6] Despite the importance of identifying color vision deficiencies, a significant majority of schoolchildren are unaware of their color vision status, and untreated CVD could negatively impact a student's academic performance.[7] The Ishihara test is used often in practise because it is easy to administer, generally accessible, and intended to screen for congenital colour vision anomalies. Each plate has a matrix of dots organised to represent a centre form or number that the participant is asked to identify. The test plate is followed by 16 plates. Normal participants will be able to read all the numbers, but a person with a color blindness will only be able to recognise some of the digits. The impact of colour blindness on one's work, health, and emotions are extremely important.[8]

In Pakistan, there is a dearth of data available on the frequency of color blindness. Specifically, there is insufficient statistics available on color blindness for school-going children in Karachi. The purpose of this study is therefore to identify the current incidence and prevalence of color blindness among school children in Karachi as well as to evaluate the awareness of this condition.

METHODS

This Cross-sectional was conducted in different primary schools of Karachi in collaboration with department of physiology, Jinnah Medical and Dental College, Karachi from October 2020 December 2020. The Hospital's Ethical Committee granted approval, as evidenced by Letter no 00054/20. Furthermore, written consent was obtained from the parents or guardians of all participants involved in the study and they all study participants were evaluated through questionnaire about demographic profile as age, gender, ethnicity, and history of eye disorder. Ishahara Chart was used to evaluate color blindness.

The data was inputted into Statistical Package for Social Sciences (SPSS) version 20. The qualitative variables have been presented in the form of frequencies and percentages, while the quantitative variables have been presented as mean and standard deviation in study participants.

RESULTS

A study was conducted to assess the prevalence of color blindness among primary school children in Karachi. The sample consisted of 148 children aged between 5-10 years, who were screened across four primary schools. Of the sample, 75 were male students and 73 were female students. The screening revealed that 16 children were afflicted with color blindness accounting to a prevalence of 10.8% among primary school going children in Karachi. It was comprising of 9 (12 %) males and 7 (9.6%) females color blind children. There were 6(28.6%) out of the 16 color blind students were with found positive family history by a significant p-value of 0.013. This study was showing 12 (8.1%) color blind students had predominant red isolated and other color blindness, while 7 were screened for green isolated and other color blindness. Our study revealed a significant p-value of <0.001 for green and red color blindness association of 7(5%) children out of the 148. A significant correlation between color blindness and night blindness was found in 11 out of 16 color blind students (p-value $= 0.002$). A number of participants in current study were found unaware of their color blind illness with significant p-value of <0.001.

Variable	Frequency (n) (%)
Gender	
Male	75 (50.7%)
Female	73 (49.3%)
Religion	
Islam	138 (93.2%)
Christian	10 (6.8%)
Ethnicity	
Sindh	88 (59.4%)
Others	60 (40.5%)
Consanguinity	
No	110 (74.3%)
Yes	38 (25.7%)
Family History of color blindness	
No	127 (85.8%)
Yes	21 (14.2%)
Color Blindness	
Yes	16 (10.8%)
No	132 (89.2%)

Table-I. Basic characteristics of the study participants

Variable	Colour Blindness Absent	Colour Blindness Present	P-Value (a)
Gender			
Male	66(88.0)	9(12.0)	0.637
Female	66(90.4)	7(9.6)	
Family history of colour blindness			
No	117(92.1)	10(7.9)	0.013* b
Yes	15(71.4)	6(28.6)	
Tends to confuse colour			
No	123(96.9)	4(3.1)	<0.001* b
Yes	9(42.9)	12(57.1)	
Finds difficulty in differentiating colour			
No	116(98.3)	2(1.7)	<0.001* b
Yes	16(53.3)	14(46.7)	
Night blindness			
No	92(94.8)	5(5.2)	0.002*
Yes	40(78.4)	11(21.6)	

Table-II. Association of colour blindness with basic characteristics

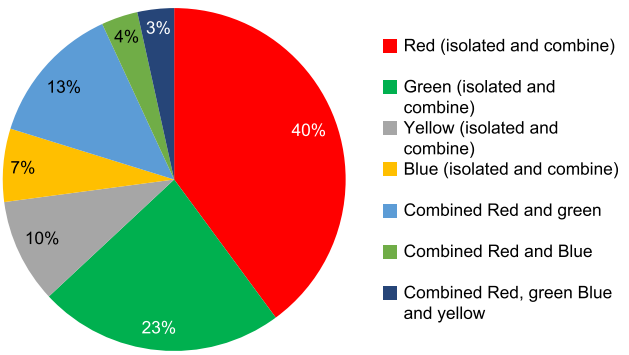

Figure-1. Percentages of different types of color blindness

Green Color Blindness	Red Color Blindness Absent	Red Color Blindness Present	P-Value b
Yes	134 (95%)	7(5 %)	<0.001*
No	2(28.6 %)	5(71 %)	

Table-III. Association of red colour blindness with green colour blindness

DISCUSSION

A class of degenerative retinal illnesses with clinical and genetic diversity is known as retinal dystrophies (RD). In this progressive diseases, common manifestations include colour blindness or night blindness, anomalies in peripheral vision, and eventual progression to total blindness.[1]

According to the WHO's 2009 report, 6 million children under the age of five are estimated to be night blind in Pakistan. In Pakistan's NWFP, children between the ages of 6 and 12 are evaluated for their risk of developing night blindness and colour blindness. In Karachi, most primary school pupils and youngsters—nearly 20%—are affected by these ailments.[9]

Colour Vision deficiency (CVD) aka colour blindness affects about seven to eight percent of the population. The majority of colour vision deficiency affects males with less than 1% affecting females.[10] We conducted this study to asses color blindness prevalence in primary school children in Karachi.

One of the studies is showing prevalence of 3% to 8% in various cities of Pakistan, which is very close to our findings.[11] One of the studies is showing same finding like our study of male children predominance than female.[12]

In our study prevalence of color blindness in children was found 10.8 %. Prevalence of colour vision deficiency in European Caucasians is about 8% in men and 0.4% in women. In Chinese and Japanese, it ranges between 4% to 6.5%. However, there is marked difference in prevalence of colour vision deficiency in males and females of Europeans and Asian population. 6 Few prevalence studies have been reported from various regions of world. The estimated prevalence in Turkey is 7.3%, Iran 4.7%, India 2.8% to 8.2% (ethnic variations), and Saudi Arabia 2.9%.[16]

Another research work Studies undertaken in Southern Ethiopia and Pimpri and Pune was showing frequency as like this current study frequency of color blindness as 10.8%[6,7]

Male predominance than female was one of the important result of our study. A Published study result are comparable with our findings of the male children predominance in color vision deficiency because CVD related to X chromosome.[11]

One of clinical research findings is consistent with

the findings of our current study and indicated that male children had more prevalent color vision impairment than female children.[13]

The result of a study conducted in the Republic of China shows that male children outnumber female youngsters like the outcomes of recent research study.[14]

A significant (p 0.05) positive correlation between family history and color blindness was found in this study. A published study with findings that are consistent with our own suggests that color blindness and family history are strongly correlated.[15]

One of the clinical research studies that has been published indicates a positive association between family history and color blindness, which is coherent with the findings of our current study.[15]

In our study we found out that there was an association of color blindness with night blindness. With p value significant (p-value=0.002).so one of the pioneering findings in our research study was the discovery of night blindness association color blindness and only scanty data is present about this association.

In our study we found out that some of them were not aware of their illness of color blindness and it was statistically significant. Similar finding was present in one of published study conducted in Kingdom of Saudia Arabia.[16]

The importance of color vision deficiency awareness was also emphasized in one of published articles showing the same level of ignorance of this illness as in our study result.[17] In line with our current study findings, another research publication has revealed a notable lack of awareness regarding color blindness among the participants of the study.[18]

One of the research findings was showing more prevalence of Red green color blindness than other types of color blindness as like our current study outcome.[19]

A clinical study has demonstrated a rise in the prevalence of red-green color blindness, which aligns with the outcomes of our own investigation.[20]

The results of our study may not be comparable to those of the school study conducted in a rural environment because it was a screening study performed in an urban context. Additionally, we were unable to further break down refractive defects into subtypes because to time constraints and practical challenges. Between public and private schools, there is a significant disparity in sample size. Ishihara chart tests for color vision can miss detecting a lesser variation.

CONCLUSION

Prevalence of color blindness in primary school children of Karachi is 10.8%. The percentage of color vision deficiency was found higher among males as compared to females. Sex, religion, consanguineous marriage between parents, myopia and positive family history and night blindness are factors found to be related with the children's color blindness. This study also revealed a significant lack of awareness of color blindness. Hence, it is imperative for children to be screened at the time of school admission for any visual defects so they may be helped accordingly. In addition to this, awareness of color blindness should be enhanced by conducting routine color vision screenings at schools which will ensure that affected individuals recognize their limitation, acclimate, and orientate their choice of future careers.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

SOURCE OF FUNDING

There are no sponsors for the research being carried out, it's a self-sponsored research.

REFERENCES

1. Chawla H, Vohra V. **Retinal dystrophies.** 2023 Mar 16. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023 Jan–. PMID: 33232049.

2. Irshad S. **Prevalence of Night Blindness due to vitamin A deficiency in Pakistan: An overview.** International Journal of Recent Research in Life Sciences (IJRRLS) [Internet]. 2022 Mar; 9(1):1-9. Available from: www.paperpublications.org

3. Elsherif, M., Salih, A. E., Yetisen, A. K., Butt, H., **Contact lenses for color vision deficiency.** Adv. Mater. Technol. 2021; 6:2000797.

4. Niroula DR, Saha CG. **The incidence of color blindness among some school children of Pokhara, Western Nepal.** Nepal Med Coll J. 2010 Mar; 12(1):48-50.

5. Gretchyn Bailey. **Colour blindness: Types of Colour Blindness.** All About Vision. 2019.

6. Gordon N. **Colour blindness. Public Health.** 1998 Mar; 112(2):81-4.

7. Cole BL. **Assessment of inherited colour vision defects in clinical practice.** Clin Exp Optom. 2007 May; 90(3):157-75.

8. Bowling B. **Kanski's clinical ophthalmology. A systematic approach.** 8th edition. Sydney: Elsevier; 2016.

9. Irshad S. **Prevalence of Night Blindness due to vitamin A deficiency in Pakistan: An overview.** International Journal of Recent Research in Life Sciences (IJRRLS) [Internet]. 2022 Mar; 9(1):1-9. Available from: www.paperpublications.org

10. Munawar T, Fatima N, Fatima T. **Frequency of color blindness amongst the youngest age group in southern Punjab province of Pakistan.** Pak Armed Forces Med J. 2018; 68(5):1190-3.

11. Mian Sahib Zar, Muhammad Shoaib Akhtar, Abdul Rehman Haris, Muhammad Aslamkhan. **Colour vision deficiency and consanguinity in Pakistani Pukhtoon Population.** Adv Life Sci. 2020 Aug; 07(04):237-9.

12. Elshazly, Alaa A.B, El-Hinnawi, Hazem M, Osman, IhabM. **Prevalence and types of color vision deficiency among primary school students in Alexandria.** Delta Journal of Ophthalmology. 2021; 22:10.4103/djo.djo_19_21.

13. Moudgil T, Arora R, Kaur K. **Color Vision Impairment in School Children.** Highlights of Medicine and Medical Research. 2021 Jun; 15:9-17.

14. Gao JG, Tian M. **Prevalence of color vision deficiency among Chinese college students and their quality of life.** Int J Ophthalmol. 2023; 16(9):1542-8.

15. Khairoalsindi OA, Almasoudi BM, Bamahfouz AY, Alghamdi AA, Siddiqui MI. **Prevalence and determinants of color vision defects among preparatory university students at Makkah, Saudi Arabia.** Middle East Afr J Ophthalmol. 2019 Sep 30; 26(3):133-137.

16. Naela B., Alamoudi, Razan Z., AlShammar, Reem S. AlOmar, et al. **AlShamlan Abdullah A. Alqahtani, and Naheel A. AlAmer. Prevalence of color vision deficiency in medical students at a Saudi University.** J Family Community Med. 2021 Sep 7; 28(3):196–201.

17. Bingham R, Dietrich SW, Goelman D. **Strategies to improve accessibility for learners with color vision deficiency.** ACM Inroads. 2019 Feb 8; 10(1):52-6.

18. Raynor NJ, Hallam G, Hynes NK, Molloy BT. **Blind to the risk: An analysis into the guidance offered to doctors and medical students with colour vision deficiency.** Eye (Lond). 2019 Dec; 33(12):1877-1883.

19. Álvaro L, Linhares JMM, Formankiewicz MA, Waugh SJ. **Coloured filters can simulate colour deficiency in normal vision but cannot compensate for congenital colour vision deficiency.** Sci Rep. 2022; 12(1):11140.

20. Grzybowski A, Kupidura-Majewski K. **What is color and how it is perceived?** Clinics in Dermatology [Internet]. 2019 Sep 1; 37(5):392-401. Available from: https://pubmed.ncbi.nlm.nih.gov/31896397/

AUTHORSHIP AND CONTRIBUTION DECLARATION

No.	Author(s) Full Name	Contribution to the paper	Author(s) Signature
1	Sassi Kanwal	Main idea, Writing and editing manuscript, calculating result.	
2	Ahtishsm Saleem	Data collection, Writing manuscript.	
3	Khulood Shahid	Data collection, Editing manuscript.	
4	Faiza Nasir	Result calculation, writing manuscript, references.	
5	Areeb Amir	Data collection.	
6	Syeda Bariah Hussain	Editing manuscript.	